SPECIES OF CERCOSPORA ON SMILAX IN THE UNITED STATES

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In the identification of a Missouri *Cercospora* on *Smilax* leaves it was found desirable to examine rather critically authentic material of the different species reported on that host. These species are as follows: *C. Smilacis* de Thuem; *C. Smilacina* Sacc.; *C. Petersii* (Berk. & Curt.) Atk.; *C. mississippiensis* Tracy & Earle; *C. subsanguinea* Ell. & Ev.; and *C. nubilosa* Ell. & Ev. Of these, *C. nubilosa* can be left out of the subsequent discussion, since an examination of the type collection in the herbarium of the Missouri Botanical Garden shows that it is on leaves of *Dioscorea villosa* L. and not on *Smilax* as originally reported. On the original label the host is recorded as "Smilax ?," but the doubt indicated by the question mark was not incorporated in the record when the species was described. However, comparisons of the leaves with those of *Dioscorea villosa* L. shows conclusively that they are from plants of the latter species.

C. subsanguinea has been available only from one collection, on *Maianthemum canadense*, distributed in 'Fungi Columbiana,' No. 4110. On this host it forms irregular necrotic areas 1 cm. or more broad and long, not bordered by a distinct margin. This is in sharp contrast to the type of spot produced by the other species on *Smilax*. The fasciculate conidiophores are abundant on the lower side of the leaf over all the dead area. They measure 40–240 × 6 μ. The spores also are distinctive, being practically cylindric, 10-celled or more when mature, and measure 45–120 × 5–6 μ. If these are the characters of that species when on *Smilax* as well, it need not be confused with the species discussed below.

The other collections examined, numbering in all about thirty, readily fall into two groups on the basis of size and shape of the spores. Before describing these in detail it may be well to state that an examination of this series of collections has demonstrated

conclusively that one can easily be misled by failing to recognize the variability in the shape and coloration of the conidiophores in young and old specimens. Probably in all species of *Cercospora* the conidiophores are at first straight and pale-colored (pl. 41, fig. 4), i.e., pale fuscous or pale cinnamon. The conidia originate apically, and one may find an entire collection in which the conidiophores and the conidia are in this stage of development. If the fungus continues growth, however, the apical conidium is pushed aside as the conidiophore grows distally from a point near the point of origin of the first conidium. This manner of growth forms an offset in the conidiophore hypha at that point. Another conidium is produced on the apex of the new growth, and it in turn may be pushed aside and another offset results. As a result of this method of growth an old conidiophore may become very irregular at its apex. At times the direction of growth assumed by the conidiophore after the production of one conidium may be almost at right angles to that of its previous growth, in consequence of which the mature conidiophore may present a sharp elbow near its distal end (pl. 41, fig. 7). Likewise the color of the conidiophore becomes darker with age, so that while in a young condition it may appear rather pale, in an older stage it assumes a darker color, in the species discussed here becoming dark reddish-brown or chestnut on the lower part, the apex remaining somewhat paler.

Length of the conidiophores is also a factor on which little reliance can be placed in the genus if the conditions in the species on *Smilax* can be taken as a criterion. For example, in a collection distributed by Nash in 'Plants of Florida,' No. 1872, the conidiophores measure 40–75 μ long, and essentially the same measurements are obtained from de Thuemen, 'Myc. Univ.' No. 1670. However, in Nash, 'Plants of Florida,' No. 1893, they measure 45–135 μ and in a collection by Peck at Manor, L. I. (Herb. N. Y. State Mus.) they measure 72–225 μ. Yet in other characters these three collections are so similar that there can be no doubt they should be referred to the same species. Likewise a collection by Peck at Wading River, N. Y., gives conidiophores 50–140 μ, while one at Arcadia, Mo. (Overholts Herb. 10426) has them 75–210 μ; in 'Plants of the Gulf States,' No. 7802, they

are 150–180 μ long; and in Nash, 'Plants of Florida,' No. 2125, they are 105–165 μ. Moreover, I have found that mounts from different spots on the same leaf give about as much variation as may be exhibited by different collections, so that it has become quite evident that, in the species on *Smilax* at least, little reliance can be placed on the length of the conidiophores.

After examining all the available collections it is apparent, as stated above, that they readily fall into two categories on the shape and size of the spores, so that of the four described species yet to be considered, two only can remain as valid. One of these is *C. Smilacis* de Thuemen, in which the conidia are subcylindric, tapering very gradually to a narrowed apex, and hence in reality slightly obclavate when seen on the conidiophores. Frequently they are considerably curved. They measure for the most part 60–135 × 4–5 μ, but some as short as 40–50 μ are to be found, and perhaps longer ones also could be located. The septations are most frequently only two or three in number but may vary to ten or eleven, or perhaps more (see pl. 40).

The other collections must be referred to *C. Smilacina*. American specimens were first so identified by Saccardo, the material being the same collection that de Thuemen had apparently referred for Peck to his own *C. Smilacis*. Since Peck reported it as this species (Ann. Rept. N. Y. State Mus. **33**: 29. 1880) it is sometimes cited in synonymy as *C. Smilacis* Peck. The species differs from *C. Smilacis* in the conidia that are usually rather abruptly narrowed at one end and have a tendency to be snow-shoe-shaped or the shape of a tailed pumpkin seed. Most of the conidia measure 40–65 × 5–6 μ, but a few are as short as 30 μ and 4–5 μ in diameter, while occasionally a spore as much as 75 μ long has been seen. They may be as much as 8-celled, but usually show less than that number. In general, therefore, they are much shorter than those of *C. Smilacis* and are more sharply contracted at one end (see pl. 41).

How often it occurs that *Cercospora* conidia are clavate and not obclavate on the conidiophores, remains for further study to determine. As originally founded by Fresenius ('Beitrage zur Mykologie,' p. 91, 1863) the genus is based on *C. Apii*, which he illustrates as with obclavate conidia, and the usual conception

of the genus involves that characteristic. While I have not seen a large number of clavate spores on conidiophores in *C. Smilacina*, yet they have been observed several times, though always obviously immature, and at a later stage of maturity they may possibly take a more obclavate form.

I find nothing in the character of the spots produced by these two species to aid in their macroscopic separation. They vary to a considerable extent on the different hosts, with variation in thickness and texture of the leaves. Always the spots produced by both species are subcircular in form and at first dark in color, the center usually becoming lighter in color with age, leaving a narrow, dark red or purplish, often raised margin. Yet in some collections the margin is not well marked. The conidiophores are usually hypophyllous in both species, but at times are amphigenous, though this tendency to occur on both surfaces seems more marked in *C. Smilacis* than in *C. Smilacina*.

A few words may be said regarding *C. Petersii*. The species was originally described as a *Helminthosporium* (Grevillea **3**: 102. 1875), but was transferred to *Cercospora* by Atkinson (Jour. Elisha Mitchell Scientif. Soc. 8: 25. 1892). I have examined mounts from the type collection of this species but failed to find the conidia and found only a few conidiophores, and was not able to arrive at any decision as to the exact status of the species. In the sense of Atkinson (*l.c.*) and as determined in several collections by Ellis it most certainly is *C. Smilacina*, and I am of the opinion that it must be regarded as a synonym of that name. It is recorded in Saccardo's host index as on the stems of *Smilax*, evidently an error, since the original description specifically locates it on the lower surface of the leaves of *Smilax* and of *Laurus*.

The following diagnoses of the two species most concerned in this treatise are appended:

Cercospora Smilacis de Thuemen, Myc. Univ. No. 1670. 1880. Pl. 40.

C. mississippiensis Tracy & Earle, Bull. Torr. Bot. Club **22**: 179. 1885.

Spots subcircular, usually limited by the veins, 1–7 mm. in diameter, at first dark purplish red, then becoming paler at the

center while retaining a dark conspicuous margin; conidiophores fasciculate, hypophyllous or amphigenous, septate, pale cinnamon to fuscous or chestnut, at first straight and paler at the tips, in age becoming chestnut color and the tips nodulose or wavy, 45–225 μ long, 3–5 μ broad; conidia subcylindric, gradually narrowed at the apex, hence somewhat obclavate, 3–4-celled or becoming 10- to 14-celled, pale fuscous, 60–135 × 4–5 μ.

On living leaves of various species of *Smilax*.

The species differs from *C. Smilacina* Sacc. in the longer spores that are sub-cylindric and not sharply narrowed.

Specimens examined: de Thuemen, Myc. Univ. Nos. 1670 (type) and 1768; Starkville, Miss., 1891, *Tracy* (type of *C. mississippiensis* Tracy & Earle) (Mo. Bot. Gard. Herb. and Herb. N. Y. State Mus.); Manor, L.I., *Peck* (Herb. N. Y. State Mus.); Columbus, Miss., 1895, *Tracy* (Mo. Bot. Gard. Herb.); Nash, Plants of Florida, Nos. 1893, 1872, and 2073 (Mo. Bot. Gard. Herb.); Ellis, N. Am. Fungi, No. 1251 (Mo. Bot. Gard. Herb.); Bairds, Miss., *Tracy* (Mo. Bot. Gard. Herb.).

Cercospora Smilacina Sacc. Michelia **2:** 364. 1881. Pl. 41.
? C. Petersii (Berk. & Curt.) Atk. Jour. Elisha Mitchell Scientif. Soc. **8:** 25. 1892.
? Helminthosporium Petersii Berk. & Curt. Grevillea **3:** 102. 1875.

Spots subcircular, usually limited by the veins, 1.5–5 mm. in diameter, at first uniform dark red or purplish black, becoming paler at the center as the spot expands, retaining (usually) a dark, somewhat raised border; conidiophores hypophyllous or rarely amphigenous, fasciculate, septate, pale cinnamon to chestnut below, usually paler above and there quite wavy or nodulose in extreme age, sometimes bent almost at right angles near the upper end, 50–215 μ long; conidia terminal and lateral, rather abruptly narrowed toward one end, pale fuscous to brownish, usually 2- to 4-celled, sometimes 6- to 8-celled, 40–65(–75) × 6 μ.

On living leaves of various species of *Smilax*.

The species is easily separated from *C. Smilacis* by the conidia that are rather abruptly narrowed near the middle, and less than 75 μ long.

Specimens examined: Wading River, N. Y., 1879, *Peck* (Herb. N. Y. State Mus.); Shelter Island, N. Y., *Clinton* (Herb. N. Y. State Mus.); Plainville, Conn., 1883, *A. B. Seymour* (Mo. Bot. Gard. Herb.); Ravenel, Fungi Am. Nos. 166 and 616 (Mo. Bot. Gard. Herb.); Hume, Florida Fungi, No. 62 (Mo. Bot. Gard. Herb. and Herb. N. Y. State Mus.); Tracy, Plants of the Gulf States, No. 7802, Auburn, Ala., 1897 (Mo. Bot. Gard. Herb.); Auburn, Ala., 1896, *Underwood* (Mo. Bot. Gard. Herb.); Nash, Plants of Florida, No. 2125 (Mo. Bot. Gard. Herb.); Seymour & Earle, Economic Fungi, No. 199 (Mo. Bot. Gard. Herb.); Bartholomew, Fungi Col. No. 2808 (Mo. Bot. Gard. Herb.); Arcadia, Mo., 1926 (Overholts Herb., No. 10426, and Mo. Bot. Gard. Herb.).

Explanation of Plate

PLATE 40

Cercospora Smilacis

Fig. 1. Conidia from de Thuemen, Myc. Univ. 1768. × 400.

Fig. 2. Fascicle of conidiophores emerging through a stoma. Ellis, N. Am. Fungi, 1251. × 160.

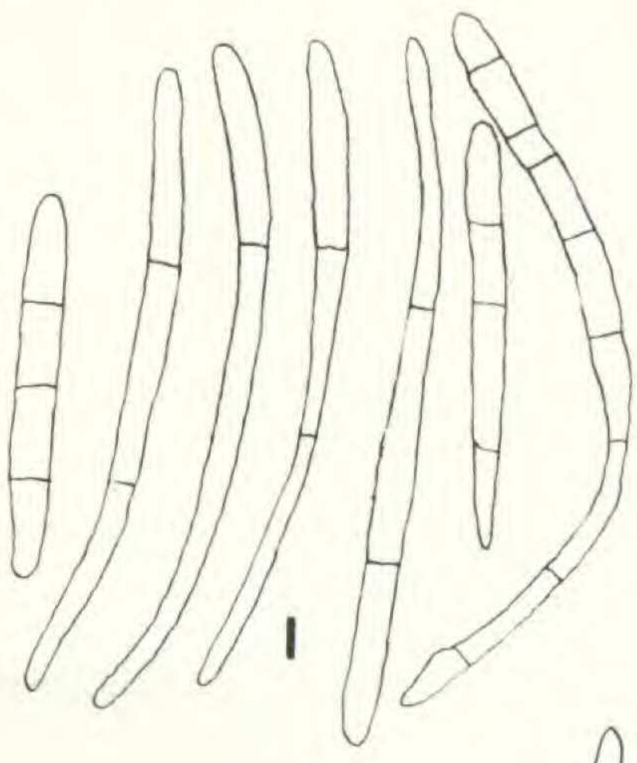
Fig. 3. Conidiophores, one bearing an obclavate conidium. From de Thuemen, Myc. Univ. 1768. × 400.

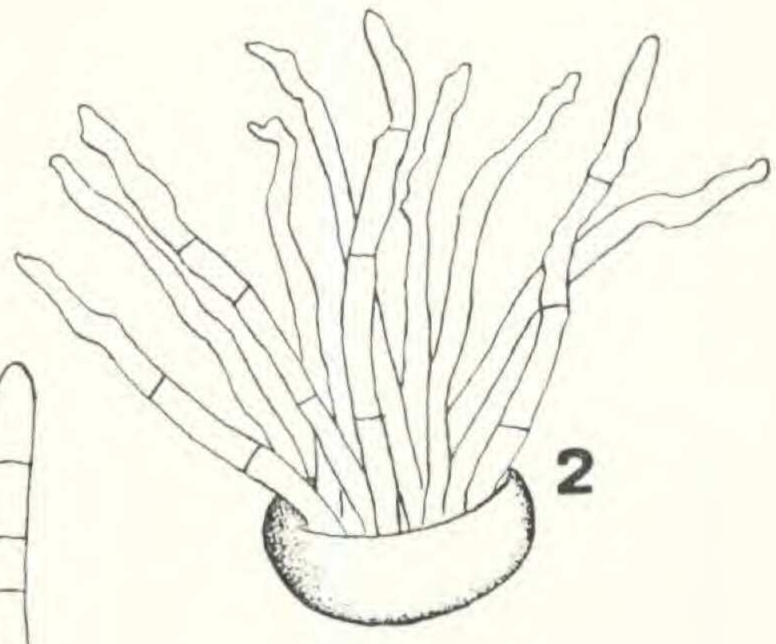
Fig. 4. Conidiophores, one bearing a conidium. From deThuemen, Myc. Univ. 1670. × 400.

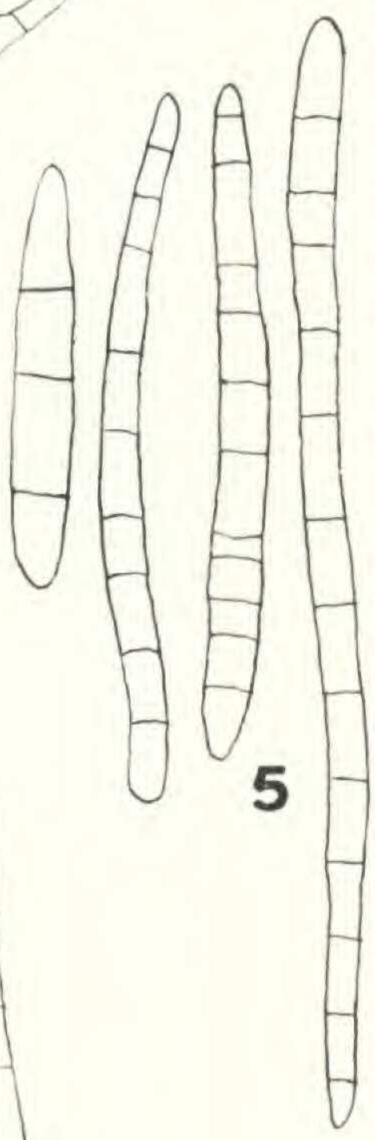
Fig. 5. Conidia. From Ellis, N. Am. Fungi, No. 1251. × 400.

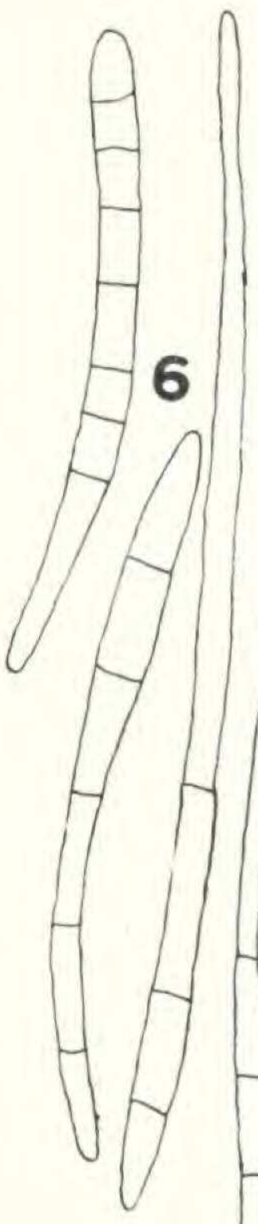
Fig. 6. Conidia. From the type collection of *C. mississippiensis*. × 400.

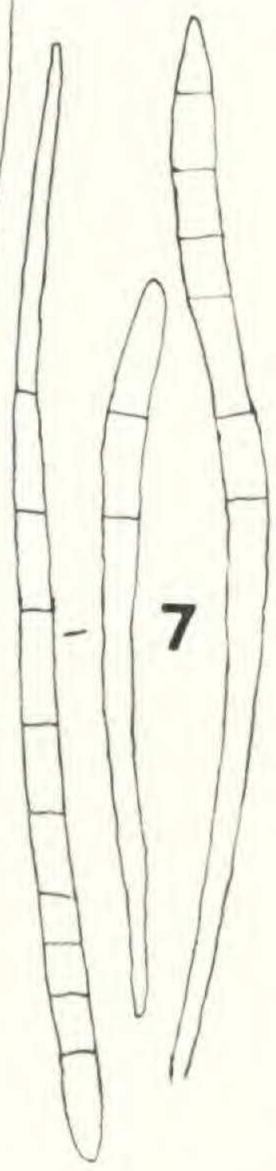
Fig. 7. Conidia. From collection at Starkville, Miss., by Tracy, 1892. × 400.

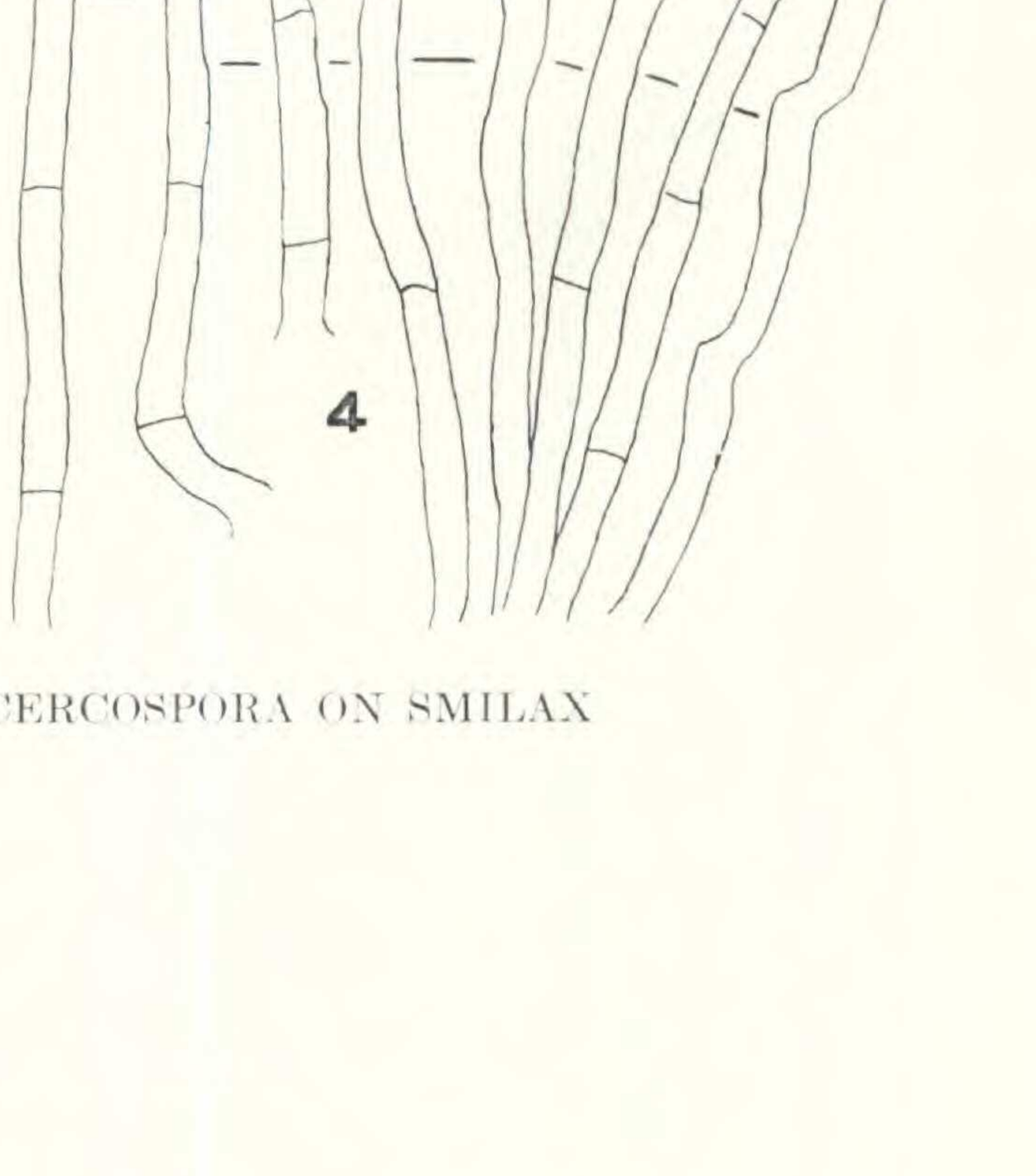












OVERHOLTS—CERCOSPORA ON SMILAX

Explanation of Plate

PLATE 41

Cercospora Smilacina

Fig. 1. Conidia. From Tracy, Plants of the Gulf States, No. 7802. × 420.
Fig. 2. Conidia. From collection at Arcadia, Mo., 1926, Overholts Herb. 10426. × 420.
Fig. 3. Conidia. From Seymour & Earle, Economic Fungi, No. 199. × 420.
Fig. 4. Conidiophores in young condition. From collection at Auburn, Ala., 1896. × 420.
Fig. 5. Conidia. Same as fig. 4.
Fig. 6. Conidia and two conidiophores. From Bartholomew, Fungi Col. 2808. × 420.
Fig. 7. Fascicle of conidiophores. From collection at Arcadia, Mo., 1926, Overholts Herb. 10426. × 165.
Fig. 8. Old conidiophore. Same as fig. 7. × 420.
Fig. 9. Old conidiophore. From Seymour & Earle, Economic Fungi, No. 199. × 420.
Fig. 10. Conidiophore. From Tracy, Plants of the Gulf States, No. 7802. × 420.
Fig. 11. Two conidiophores and two conidia. From collection at Wading River, N .Y., Peck, 1879. × 420.